APPARATUS FOR DUAL PHASE CHROMIUM REMOVAL AND ENERGY RECOVERY AND METHODS THEREOF

IITM Technology Available for Licensing

Problem Statement

- The sediment strata play a vital role in predicting the quality of water bodies like lakes, streams and others.
- These waterlogged sediments contain both organic and inorganic pollutants discharged from industrial effluents or other wastewater or agriculture runoff streams, which deteriorate the quality of the sediments.
- After a long-saturated period, the sediment release back the pollutants (heavy metals e.g. Cr, Cu, Zn, As) to the overlying water phase, thereby causing contamination in the dual stratum.
- There has been discussion in a few non-patent and patent literature regarding removing the contaminated sediments but failed to disclose the solution as described in the present invention.

Technology Category/ Market

Chemical Engineering: Electrochemical cell;
Industry: wastewater treatment plant, energy and power industry.
Applications: Fuel cell or batteries, serve as a source of clean environment with power production from various water bodies in several remote location, wastewater treatment plant.
Market: The global **electrochemical cell** market is projected to grow at a **CAGR** of **15.6%** during forecast period of **2021** to **2027.**

Technology

- Present invention describes **an apparatus and methods of remediation** of Cr from dual phase (aqueous and soil matrics) through an electrochemical driven process without the use of the additional power.
- Further, said apparatus & electrochemical method provides reduce carcinogenic metal ion from dual phase (sediments and water).
- Generates power from dual phase.
- Present invention talks about an electrochemical cell which comprises of a membrane-less single chamber, wherein

1. **Anode is nickel foam, and said anode submerged in the wetland soil;**
2. **Catalyst free cathode is carbon felt, and said cathode suspended in the water phase of the wetland, and said anode & cathode connected to a constant load;**
3. **Urea/cow dung is added as fuel to the system enabling Cr(VI) reduction both from the soil and water surfaces; the electrooxidation of urea generates electron that partially accepted by Cr(VI) in the soil, & remaining electrons travel via the current collector in the overlying water surface**

- The above process leads to the oxidation of urea/cow dung and the reduction of Cr(VI) simultaneously.

Intellectual Property

IITM IDF Ref. 1520;
IN Patent No. 422969 (Granted)
PCT Application No. PCT/IN2018/050423

TRL (Technology Readiness Level)

TRL- 3/4, Proof of Concept ready, tested and validated in Laboratory

Research Lab

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Key Features / Value Proposition

❖ ***Technical Perspective:***

1. An electrochemical cell or apparatus compact in size, contains a membrane-less single chamber for reduction of Cr(VI) from both sediment and water phase.
2. Said cell generates power from contaminated wastewater and sediment matrices.

❖ ***Industrial Perspective:***

1. Oxidizing the wasteful organic matter as an electron source, and achieving the benefits of cleaning up sediments rich in organic loading by using said organic matter.
2. Power production from both phases and the apparatus is economic to produce said power.

Images

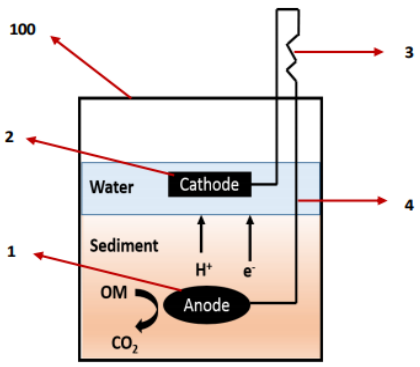
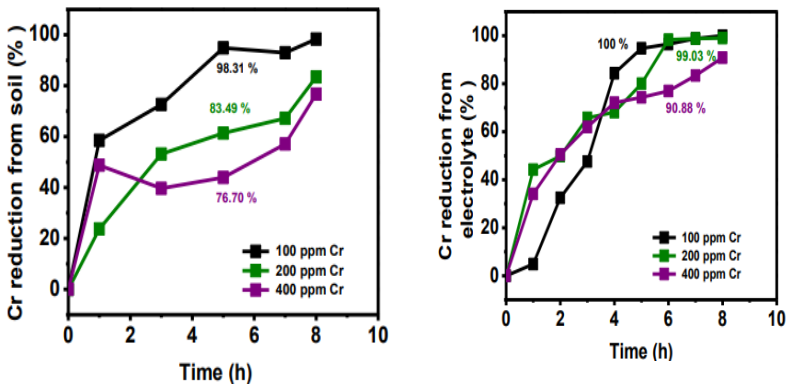
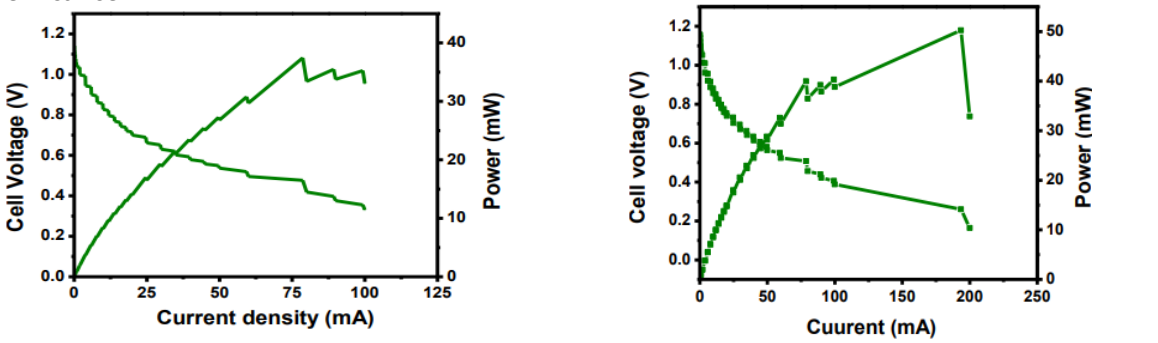


FIG.1: Illustrates single chambered membrane free soil water electrochemical cell.



FIGs.2A & 2B: Illustrate effect of initial metal ion concentration and removal efficiency at optimized urea concentration as organic matter from both the electrolyte phase and soil phase.



FIGs.3A & 3B: Illustrate power density curve with 1000 ppm Cr in dual phases a) urea and b)cow dung as organic matter

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